Gender, Test Anxiety and Self-concept as Factors in Basic Science Achievement of Junior Secondary School Students in Ikom Education Zone, Cross River State

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Abstract

This study examined the influence of Gender, test anxiety and self-concept on Basic Science achievement of Junior Secondary School Students in Ikom Education Zone of Cross River State, Nigeria. The study sample comprised 490 Junior Secondary three students drawn from a population of 3,317 using the stratified and simple random sampling technique. Three (3) research questions and three (3) corresponding hypotheses guided the study. The ex-post facto design was employed in the study and data collection was by means of Test Anxiety and Self-concept Questionnaire (TASCQ) as well as Basic Science Achievement Test (BSAT). Both TASCQ and BSAT were validated by two experts in Measurement and Evaluation and two in Basic Science. The reliability indices of TASCQ and BSAT were established using Cronbach alpha and KR-20 method respectively and this yielded 0.69 for TASCQ and 0.76 for BSAT. The hypotheses were tested using descriptive statistics and independent t-test. Results of data analysis showed significant influence of test anxiety and self-concept on Junior Secondary School Students' Basic Science achievement but non for gender. Based on the findings, the paper recommended that Science teachers should employ effective teaching methods in Science classroom to improve students' self-concept and also reduce test anxiety.

Keywords: gender, test anxiety, self-concept, basic science achievement

1. Introduction

Science can be conceived as a structured field of study that constructs and arranges knowledge through detailed and systematic description of the universe, while science education as a field of study entails the process of sharing scientific contents and procedures with individuals (Ugwu & Nwagbo, 2019). Science education as a field of study is generally made up of other sub-fields such as some branches of the social sciences, scientific contents and some aspects of teaching pedagogy, (Berube, 2008). Basic Science is a knowledge obtained by observation and a comprehensively detailed process inquiring about the formation of animate and inanimate objects within our immediate environment. According to Okoyefi and Nzewi (2013) basic science is one of the core subjects for basic education and is a foundation for subsequent learning in science. Basic science as an integrated science course combines all the Science subjects, such as Biology, Chemistry, Physics, Health Science, etc., taught at the lower, middle and upper basic education levels. The general objective of basic science education is to enable pupils observe and explore the environment using their senses and their hands. This objective has been given national recognition through its enshrinement in the curriculum of basic science and technology, as implemented in the National Policy on Education. This curriculum was designed based on the principles of spirality of themes, ranging from the first year to the nineth year of a child's academic progress. This implies that the curriculum begins with the lower basic (primary 1-3) to the middle basic (primary 4-6) and to the upper basic (JSS 1-3). This is continuous across the 9 years of basic education in order to sustain the interest of learners and promote meaningful learning (FRN, 2014).

Basic Science as a discipline has gained prominence in all aspects of human endeavors, due to the role it plays in the development and sustenance of a nation. This raises questions on how Basic Science students can be motivated to invest their time and energy towards understanding the tenets and applications of Basic Science as a field of study (Broussard and Gaarison, 2014). This concern is premised on the persistent decline in academic achievement of students generally and in science subjects in particular. The dwelling trend in basic science achievement seems to indicate that more energy should be exerted in ensuring that students become more interested in learning the subject. From literature, there are evidence that some learners' personality variables could influence students' learning outcomes (Akinsola, 2008; Badru, 2017; and Ifamuyiwa, 2018). Such student's personality variables include gender, test-anxiety, self-concept and cognitive entry behaviour.The fact that students' personality variables may influence students' achievement in Basic Science necessitates the study on students' achievement in Basic Science as explained by gender, test-anxiety and self-concept.

Gender is often described as a social and cultural construct, shaped by roles, duties and responsibilities that are assigned to men and women within the society (Okeke, 2007). Oftentimes, gender roles are shaped by the socialization and learning process initiated by cultures and traditions, which moves from one generation to the other. This implies that gender roles are not determined biologically, but rather constructed by culture, customs, traditions and other social constructs guiding the affairs of individuals within the society. Gender is not enforced through laws but rather imposed through social institutions and self-perceptions (Nzewi, 2010). In Nigeria for instance, Nzewi (2010) has observed that there

is a strong relationship between gender roles and culture. A combination of these two elements have resulted to a stereotype revolving around sex roles, which involves classifying human activities by sex based on socio-cultural factors as well as within the context of what is deemed appropriate by the society.

Researchers in Science Education have in recent time expressed diverse opinions about gender and achievement in science, Obiekwe (2008) and Okoro (2011) reported that male students performed better in science than their female counterparts, while Okeke (2007) and Nzewi (2010) argued that females students' achievement in science is as high as that of their male counterparts when given equal opportunities. There is thus some level of inconsistency as to how gender could influence achievement in basic science and this called for a further study. Test-anxiety, on the other hand, is an inhibiting factor in learning that causes low self-esteem or inferiority complex with the appearance of being panic, helpless, distress, sweaty palms, inability to concentrate, nervous stomach and fear of failure triggered by a situation that involves a decision or judgement (Owens, et al, 2012; Kehinde, 2015). Test-anxiety makes necessary information in-valuable when concrete decisions or judgement could not be made. Learners who experience test-anxiety are often less able to perform in Basic science examination. According to Birjandi and Pourmoslemi (2010) anxiety in human varies in intensity in two parts namely severe and mild depending on the seriousness of the threat and the effectiveness of the mental security of the individual. If the security operation that an individual has is weak, he or she may psychologically see himself or herself as a failure in any learning process. A student with severe anxiety is most likely to perform poorly in examination as he/she learnt, conversely mild anxiety could be informative and may result in high achievement (Birjandi & Pourmoslemi, 2010).

Self-concept has been defined by Shavelson (2009) to mean a belief or an ideology held by an individual about themselves. These perceptions include but are not limited to the attitudes, qualities and deficiencies, capacities and limits, values and relationships that an individual holds about themselves, and to some extent, defines their identity and social construct within the society. It is considered broadly to include the perception of a person's attitude, knowledge and feelings about his/her capabilities, which he/she holds to be true about his/her personal existence (Purkey, 2016). Studies by Micoach, (2013), Dambudzo (2013) showed a significant influence of test anxiety, self-concept and students' academic achievement in science while some others did not (Ozoji, 2010, Adamu, 2016) thereby making the findings of such studies in-conclusive. It is thus against this background that this study investigated the influence of gender, test anxiety and self-concept on Basic Science achievement of Junior Secondary School Students in Ikom Education Zone of Cross River State, Nigeria.

1.1 Statement of Problem

Students' academic achievement in Basic Science over the years has witness a declining trend in Cross River State. This trend of development could adversely affect the growth of Science Education in the state if not checked and the desire of the State Government for industries, technological and economic development might remain an illusion or a mirage. The annual release of Junior Secondary School Certificate Examination Results conducted by

the State Ministry of Education justified the difficult nature and generalization of poor junior secondary school students' academic achievement in Science related subjects and Basic Science in particular. Different explanations have been offered for the decline among which are teacher quality and students' personal variables. Meanwhile students' personal variables appear to be the most cited factor in literature (Obilor, 2014, Oneyem and Okonkwo, 2016). The present study therefore seeks to determine the influence of gender, test anxiety and self-concept on Junior Secondary School students' achievement in Basic Science.

1.2 Purpose of the Study

The purpose of the study was to investigate the influence of gender, test anxiety and self-concept on Basic science achievement of Junior Secondary three (JSS 3) students in Ikom Education Zone of Cross River State, Nigeria.

1.3 Research Questions

The following research questions guided the study.

i) What is the influence of gender on Basic Science achievement of Junior Secondary School Students?

ii) How does the Basic Science achievement of Junior Secondary School Students differ on the basis of test anxiety?

iii) What difference exist in the Basic Science achievement of Junior Secondary School Students on the basis of self-concept?

1.4 Research Hypotheses

The following research hypotheses were raised;

i) There is no significant difference in the Basic Science mean achievement of junior secondary school students on the basis of gender.

ii) There is no significant difference in the Basic Science achievement of junior secondary school students on the basis of test anxiety.

iii) Basic Science achievement of junior secondary school students is not significantly different on the basis of self-concept.

2. Research Method

Design: The ex-post facto research design was used for the study. Ex-post facto was found suitable for the study because the independent variables had already occurred and the researcher had no control over their manifestation.

Population: The population of the study comprised 3,317 (male and female) junior secondary school III (JSS 3) students in public secondary schools in Ikom Education Zone (Zonal Education Office, 2020).

Sample and sampling technique: The stratified and simple random sampling technique was employed to draw the sample for the study. The schools were stratified on the basis of the Local Government Areas that made up the Education Zone. The simple random sampling technique was thereafter used to select 38 public secondary schools out of 87 secondary schools in the Education Zone. Four hundred and ninety (490) students were further selected from the 38 schools to make up the study sample. The sample distributions showed that 227 were males and 263 were females.

Instrumentation: The instrument used for the research were a 26-item questionnaire titled "Test anxiety and Self-concept Questionnaire (TASCQ) and a 30-item Basic Science Achievement Test (BSAT). Both TASCQ and BSAT were validated by two experts in Measurement and Evaluation from the Cross River University of Technology and two Basic Science Teachers to ensure their appropriateness for the study. A pilot study was conducted using students from other secondary schools that did not participate in the study to ascertain the reliability of the two instruments. The reliability indices of 0.69 and 0.76 were obtained from TASCQ and BSAT using Cronbach alpha coefficient and Kuder-Richardson formula 20 (KR$_{-20}$) respectively.

2.1 Administration of Instruments

The instruments were administered on the respondents by the researcher with the aid of three basic science teachers who served as research assistants. The 490 questionnaires were administered and retrieved on the spot and afterwards subjected to data analysis using mean standard and independent t-test.

3. Data Analysis and Results

The research questions were answered using mean and standard deviation while the t-test of independent means was used to test the hypotheses at 0.05 level of significance.

3.1 Research Question One

What is the influence of gender on Basic Science achievement of Junior Secondary School Students? The result is presented in Table 1.

Table 1. Mean and Standard Deviation of Basic Science Achievement Scores Based on Gender

Variable	Category	N	$\overline{x}$	SD
	Male	227	29.52	10.14
Gender	Female	263	28.68	10.08

Table 1 indicates that the male student had a mean achievement score of 29.52 and standard deviation of 10.14 while their female counterparts had a mean achievement score of 28.68

and standard deviation of 10.08. This shows that gender has slight influence on the Basic Science achievement of junior secondary school students in favour of the male. However, the independent t-test was employed to test if the difference was significant as shown in Table 4.

3.2 Research Question Two

How does test anxiety influence Basic Science achievement of junior secondary school students? The result is presented in Table 2.

Table 2. Mean and Standard Deviation of the Influence of Test Anxiety on Basic Science Achievement of Junior Secondary School Students.

Variable	Category	N	$\overline{x}$	SD
	Severe	299	29.01	10.62
Test anxiety	Mild	191	31.52	10.11

Table 2 shows the influence of test anxiety (categorized at two levels severe and mild) on the Basic Science achievement of junior secondary school students. The mean achievement score of severe test anxiety Basic Science students is 29.01 with standard deviation of 10.62, the mild anxiety Basic Science students has a mean achievement score of 31.52 and standard deviation of 10.11. This implies that test anxiety has influence on the Basic Science achievement in favour of the mild anxiety Basic Science students.

3.3 Research Question Three

What influence does self-concept exerts on Basic science achievement of junior secondary school students? The result is presented in Table 3.

Table 3. Mean and Standard Deviation of the Influence of Self-Concept on Basic Science Achievement of Junior Secondary School Students

Variable	Category	N	$\overline{x}$	SD
	Positive	312	30.38	10.62
Self-concept	Negative	178	28.41	10.06

Table 3 shows the mean achievement scores and stand deviations of Basic Science students with positive and negative self-concept. The positive self-concept Basic Science students have achievement mean scores of 30.38 with standard deviation of 10.62. The negative self-concept Basic Science students have achievement mean scores of 28.71 and standard deviation of 10.06. This implies that self-concept exerts influence on the Basic Science achievement in favour of the positive self-concept Basic Science students.

3.4 Testing of Hypotheses

3.4.1 Hypothesis One

There is no significant difference in the Basic Science mean achievement of junior secondary school students on the basis of gender. In order to test this hypothesis, gender was categorized at two levels viz male and female and the independent t-test was used at 0.05 level of significance. The result is presented in table 4.

Table 4. Independent T-Test Analysis of the Influence of Gender on the Basic Science Achievement of Junior Secondary School Students

Variable	Category	N	$\overline{x}$	SD	t-cal	Decision
	Male	227	29.52	10.04		
Gender					0.87	NS
	Female	263	28.68	10.08		

Not significant, P < 0.05, t-critical =1.98, df = 488

Table 4 shows that the calculated t-value (t = 0.87) is less than the critical t-value (t = 1.98), df = 488 at p < 0.05. This indicates an acceptance of the null hypothesis while the alternate is rejected. This implies that there is no significant difference in the mean achievement scores of Basic Science students on the basis of gender.

3.4.2 Hypothesis Two

There is no significant difference in the Basic Science achievement of junior secondary school students on the basis of test anxiety. The result is presented in Table 5.

Table 5. Independent t-test Analysis of Basic Science Students' Achievement Scores Based on Test Anxiety

Variable	Category	N	$\overline{x}$	SD	t-cal	Decision
	Severe	299	29.01	10.62		
Test anxiety	Mild	191	31.52	10.11	2.16	*Sign.

*Significant, P < 0.05, t-critical =1.98, df = 488

Table 5 shows the calculated t-value (2.16) is greater than the critical t-value (1.98), df 488 at p < 0.05. Based on the result, the null hypothesis is rejected and the alternate hypothesis upheld. This implies that, there is a significant influence of test anxiety on the mean achievement scores of Basic Science students in favour of the mild test anxiety Basic Science students. In other words, the mild test anxiety students had higher achievement than the

severe test anxiety Basic Science students.

3.4.3 Hypothesis Three

Basic Science achievement of junior secondary school students is not significantly different on the basis of self-concept. The result is presented in Table 6.

Table 6. Independent t-test Analysis of Basic Science Students Achievement Scores Based on Self-Concept

Variable	Category	N	$\overline{x}$	SD	t-cal	Decision
	Positive	312	30.38	10.62		
Self-concept					2.91	*Sign.
	Negative	178	28.71	10.06		

*Significant, $P < 0.05$, t-critical =1.98, df = 488

Table 6 indicates that the calculated t-value (2.91) is greater than the critical t-value (1.98) implying a rejection of the null hypothesis and acceptance of the alternative. This means that there is a significant difference in the Basic Science achievement of junior secondary school students on the basis of self-concept. Hence, students with positive self-concept recorded higher achievement than those with negative self-concept.

4. Discussion of Results

The results of the data analysis for hypothesis one presented in Table 4 showed that there is no significant influence of gender on the Basic Science achievement of junior secondary school students. This implies that male and female junior secondary school students do not differ in their academic achievement. The result is in consonance with the views of Okeke (2007) and Nzewi (2010) who argued that female students' achievement in science is as high as their male counterparts when given equal opportunity. This result may be because academic achievement has to do with mental and intellectual ability and not gender. The result is however contrary to Obiekwe (2008) and Okoro (2011) who reported that male students performed better in science than their female counterparts. Such contradiction may not be unexpected because the circumstances of gender have strongly interacted with culture to produce sex role-stereotype in line with what the society often considers as appropriate for a particular sex. There is always a mistaken impression that science subjects are not meant for feminine gender but rather for masculine gender. This is not true because academic achievement is not based on students' gender but rather on mental and intellectual abilities.

The result of the second hypothesis shown in table 5 indicated a significant difference in the Basic Science achievement of junior secondary school students on the basis of their test anxiety. The findings give credence to Birjandi and Pourmoslem (2010) who opined that a

student with severe anxiety is most likely to perform poorly in examination and conversely mild anxiety could be informative and may result in high achievement. The result in table 6 indicated that self-concept influences Basic Science achievement of junior secondary school students. In other words, a significant difference exist in the Basic Science achievement of junior secondary school students on the basis of their self-concept. The result is in agreement with Micoah (2013) and Dambudzo (2015) who established that there is a significant influence of self-concept on academic achievement in science. The result however contradicts Ozoji (2010), Adamu (2016) who found no significant influence of self-concept on achievement in science.

5. Conclusion and Recommendations

Students' personal factors such as test anxiety and self-concept exert significant influence on their achievement in Basic Science. However, Basic Science achievement of junior secondary school students is not gender dependent rather it is determined by mental and intellectual ability of the students.

Based on the result, the following recommendations are made;

1. Educational programmes should focus on improving students' intrinsic variables such as self-concept and test anxiety through a variety of students' programmes, instructional activities, community-based projects as well as challenging tasks that builds their confidence in science classrooms.

2. Science teachers should stimulate their students to actively reflect on the role of science in modern life and how it makes a difference in their lives and the society. This could be achieved through student-based instructional approach such as self-directed learning, problem-solving, and co-operative approach.

3. Students should be encouraged to develop positive self-concept towards science irrespective of their sex. Both boys and girls should be given equally opportunity to carry out scientific tasks in the classroom without any form of gender discrimination.

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